Disclosure of the Invention and Claims amended by Amendment under Article 34 of PCT, filed on October 12, 2004

DISCLOSURE OF THE INVENTION

The multi-layer magnetic part of the present invention comprises a composite sheet obtained by applying a magnetic body paste to a substrate rendering the center and periphery thereof a magnetic pattern, and by applying a nonmagnetic body pattern to a substrate rendering a part thereof except the center and periphery a dielectric pattern comprising a nonmagnetic body; a primary winding or secondary winding, or both such primary and secondary windings, provided on one face of the dielectric pattern and around the center; a primary winding or secondary winding, or both such primary and secondary windings, provided on the other face of the dielectric pattern and around the center; and a pair of magnetic sheets which are obtained by applying a magnetic body paste to a substrate and drying the paste and which hold the composite sheet and the primary and secondary windings from both sides and contact one another via the magnetic pattern.

Preferably, a composite sheet may be a single sheet or a plurality of stacked sheets. Further, preferably, if the primary and secondary windings face one another with the dielectric sheet of the composite sheet interposed therebetween, the primary and secondary windings may be alternately arranged on one face of the composite sheet or the primary and secondary windings may be alternately arranged on the other face of the composite sheet. Preferably, when the composite sheet is a plurality of sheets, a plurality of the primary and secondary windings can be provided with the composite sheet interposed therebetween. Here, preferably speaking, a through-hole that connects the primary

and secondary windings respectively may be provided in the composite sheet. Further, here, 'nonmagnetic body' means a material with a smaller magnetic permeability than at least a magnetic sheet. 'Dielectric sheet' means a sheet with a larger resistivity than at least a magnetic sheet and is also known as a dielectric sheet or insulation sheet.

In the case of the multi-layer magnetic part of the prior art, because there is a magnetic body layer between the primary and secondary windings, a leakage magnetic flux is produced in the magnetic body layer, whereby the magnetic coupling coefficient is reduced. Therefore, in the multi-layer magnetic part of the present invention, a nonmagnetic body layer (dielectric pattern) is first provided between the primary and secondary windings. Because a core cannot be formed by this means alone, the core is formed by making the center and periphery of the composite sheet a magnetic pattern and causing the pair of magnetic sheets to contact one another via this magnetic pattern. Therefore, in the case of the multi-layer magnetic part of the present invention, a nonmagnetic body layer (dielectric pattern) is provided between the primary and secondary windings, whereby a leakage magnetic flux can be suppressed. Moreover, unlike the prior art, there is no need to form the dielectric layer by applying a dielectric paste to the primary and secondary windings and, hence, there is no deterioration of the insulation of the primary and secondary windings and no widening of the gap between the primary and secondary windings.

Further, in a preferred embodiment, the composite sheet may be inserted between the magnetic sheet and the primary or secondary winding. This composite sheet acts to increase the insulation of the primary and secondary windings.

In a preferred embodiment, a composite sheet may have a magnetic pattern and dielectric pattern of equal film thickness. In this case, the film thickness of the composite sheet is fixed irrespective of location and the pair of magnetic sheets holding the composite sheet from both sides are also flat.

The fabrication method of the multi-layer magnetic part of the present invention is a method of fabricating the multi-layer magnetic part of the present invention. First, the magnetic sheet is created by applying a magnetic body paste to a substrate and then drying the paste. A composite sheet is created by applying a nonmagnetic body paste to a substrate in the form of the dielectric pattern, applying a magnetic-body paste in the form of the magnetic pattern and then drying the pastes. Thereafter, the primary winding and secondary winding are created by applying a conductor paste to the composite sheet or magnetic sheet and drying the paste. Thereafter, the magnetic sheet and dielectric sheet thus obtained are peeled from the substrate and stacked and pressurized to form a stacked body. Finally, this stacked body is fired.

According to the present invention, a multi-layer magnetic part in which a nonmagnetic body layer is provided between the primary and secondary windings can be implemented by forming a core by providing the dielectric pattern of the composite sheet between the primary and secondary windings, rendering the center and periphery of the composite sheet a magnetic pattern, and then causing the pair of magnetic sheets to contact one another via the magnetic pattern, whereby a leakage magnetic flux can be suppressed. Moreover, unlike the prior art, there is no need to form a dielectric layer by applying dielectric paste to the primary and secondary windings and, therefore, there is no

deterioration of the insulation of the primary and secondary windings and no widening of the gap between the primary and secondary windings. Therefore, the magnetic coupling coefficient can be increased while retaining the mutual insulation of the windings. Furthermore, by inserting a dielectric pattern instead of a conventional magnetic sheet, the insulation of the primary and secondary windings can also be increased.

In addition, because both the dielectric pattern and the magnetic pattern are formed in one composite sheet, in comparison with a case where the same structure is formed by stacking a dielectric sheet comprising a stacked body alone and a magnetic sheet comprising a magnetic body alone, the number of sheets can be reduced and the stacking method can be simplified.

Furthermore, the primary and secondary windings can be electrically protected by inserting a composite sheet that is the same as that described above between the magnetic sheet and the primary or secondary winding, whereby the insulation can be improved.

By providing a through-hole that connects the primary windings and secondary windings respectively in the composite sheet, the primary and secondary windings can be connected simply in comparison with a case where same are connected by means of leads or the like, whereby fabrication can be facilitated.

Because the film thicknesses of the magnetic sheet and dielectric sheet are equal, the film thickness of the composite sheet is fixed irrespective of location and, therefore, the pair of magnetic sheets holding the composite sheet from both sides can be made flat. Therefore, a wiring pattern or the like can be accurately formed on the magnetic sheet.